TITLE

APPARATUS FOR SEPARATING DIGITAL BROADCASTING SIGNAL FROM DATA TRANSMITTED THROUGH INTERNET NETWORK AND METHOD THEREOF

CLAIM OF PRIORITY

[0001]   This application makes reference to, incorporates the same herein, and claims all benefits accruing under 35 U.S.C. §119 from my application for *APPARATUS FOR SEPARATING DIGITAL BROADCASTING SIGNAL FROM DATA THROUGH IP NETWORK AND METHOD THEREOF* filed with the Korean Industrial Property Office on 1 April 2003 and there duly assigned Serial No.2003-20609.

BACKGROUND OF THE INVENTION

Field of the Invention

[0002]   The present invention relates to a digital broadcasting service, and more specifically, to an apparatus and a method for separating a digital broadcasting signal from data transmitted using an Internet network which transmits IP (Internet protocol) packet in a wire-speed by performing a comparison of an IP address in a hardware scheme without a special memory when separating Internet data and digital broadcasting signal among signals being serviced through an IP-based Internet network.

Description of the Related Art

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2   [0003]   Currently, a transmission mode to transmit a digital broadcasting signal to a subscriber in

3   a real time is divided into a transmission mode using an Asynchronous Transfer Mode (referred to

4   as ATM, hereinafter) network and a transmission mode using an IP network.

5   [0004]   Firstly, the transmission mode using the ATM network will be described as follows. Fig.

6   1 is a view showing a block diagram of a processing unit for serving a digital broadcasting signal

7   using an ATM network in the art. Referring to Fig. 1, the processing unit includes a transmission

8   media 10 such as xDSL (x-Digital Subscriber Line), optic or cable modem, and a set-top box 20

9   which receives a digital signal in a form of Moving Picture Experts Group (referred to as an MPEG,

10   hereinafter) transmitted from the transmission media 10, converts the digital signal to an analog

11   signal with which an analog television set can display a picture, and converts a compressed MPEG

12   signal to a standard picture signal by decompressing the signal.

13   [0005]   The set-top box 20 includes an ATM interface 21, an ATM MPEG 1~7 (referred to as

14   'MPEG-N') streamer 22, an MPEG decoder 23, a Digital /Analog Converter (referred to as a DAC)

15   24, and a controller 25.

16   [0006]   The processing procedure of the digital broadcasting signal transmitted through the set-top

17   box is as follows. At first, when the ATM signal is received to the transmission media 10 through

18   the ATM network 10, the signal is interfaced in the ATM interface 21 so that the digital broadcasting

19   signal is outputted to the ATM MPEG-N streamer 22 and the Internet data is outputted to a computer

20   through the controller 25.

21   [0007]   After the digital broadcasting signal is divided into its corresponding transmission units

1 (MPEG-1, 2, 3, 4 and 7) in the ATM MEPG-N streamer 22, the signal is decompressed by the

2 MPEG decoder 23, converted to an analog signal by the DAC 24 and transmitted to a corresponding

3 port of a television set.

4 [0008]   Accordingly, a user can freely select the digital broadcasting signal transmitted from the

5 broadcasting channel server and watch it on TV (television).

6 [0009]   However, the ATM network-based digital broadcasting service is provided only through

7 the ATM network. ATM equipment is expensive and disadvantageous economically in consideration

8 of the current trend that the price of the IP network is reduced more and more.

9 [0010]   Considering that Quality of Service (QoS) considered as a problem in the current IP

10 network is solved to some extent and the network is entirely evolving into IP network, there is a

11 necessity for standardizing the transmission equipment interface of the set-top box into the IP

12 interface.

13 [0011]   Hereinafter, a processing unit for digital broadcasting of a conventional IP network-based

14 set-top box will be explained.

15 [0012]   Fig. 2 is a view showing a block diagram of an apparatus for processing a digital

16 broadcasting signal using an IP network in the art.

17 [0013]   Referring to Fig. 2, the IP network-based set-top box 30 includes a Queue 31 for storing

18 the IP packet transmitted from the IP network temporarily and outputting the IP packet sequentially;

19 a memory controller 32 for processing data, Start Of Packet (SOP) and End Of Packet (EOP) signals .

20 outputted from the Queue 31; a memory 33 for storing data transmitted from the memory controller

21 32; an IP header 34 extracted from the IP packet outputted from the memory controller 32; a

1   controller interface 35 for setting and transmitting a broadcasting IP address assigned by a user; a

2   register 36 for storing the set IP address transmitted through the controller interface 35; an exclusive

3   OR gate 37 which compares the IP address stored in the register 36 and the IP header 34, and outputs

4   "0" signal if the IP address is identical with the IP header and "1" signal if not identical; and a Queue

5   38 for outputting the IP packet stored in the memory 33 to the corresponding output according to the

6   signal outputted from the exclusive OR gate 37.

7   [0014]   However, in case of the IP network-based set-top box constructed like that, since the IP

8   packet is first stored in the memory 33 as soon as it is received and it is transmitted one by one from

9   the memory 33 if the address of the IP packet is identical with the IP address of the corresponding

10 digital broadcasting service, a delay is generated necessarily in packet transmission.

11 [0015]   Since the received IP packet is determined whether the packet is for broadcasting or not

12 after the packet is first stored in the memory and the IP header is extracted, there occurs a problem

13 that it is not possible to transmit the IP packet at a wire-speed.

14 [0016]   The wire-speed means to transmit the IP packet at the same speed with the processing

15 speed of the data flowing on a line. That is, it means to process the IP packet in real-time without

16 any delay.

17   SUMMARY OF THE INVENTION

18 [0017]   Therefore, the present invention has been made in view of the above and other problems,

19 and it is an object of the present invention to provide an apparatus and a method for separating a

20 digital broadcasting signal from data transmitted using an IP network which transmits an IP packet

1 at a wire-speed by performing a comparison of an IP address in a hardware scheme without a special

2 memory when separating Internet data and digital broadcasting data (MPEG-TS) in an IP

3 network-based digital broadcasting signal process unit.

4 [0018]   It is another object to provide the extraction of a digital broadcasting signal from an IP

5 network with ease without using an expensive network processor (for example, ATM interface) in

6 an apparatus capable of receiving a digital broadcasting signal through an Internet network.

7 [0019]   It is yet another object to provide for a user to receive broadcasting service more rapidly

8 by extracting directly an IP header of an incoming IP packet in a hardware scheme without storing

9 the IP packet in a special memory.

10 [0020]   It is still another object to provide an apparatus and a method for separating a digital

11 broadcasting signal from data transmitted using an IP network that is more efficient and easier to

12 implement.

13 [0021]   In accordance with an aspect of the present invention, there is provided an apparatus for

14 separating a digital broadcasting signal from data transmitted using an Internet network, including:

15 a transmission media for transmitting signals transmitted from a server providing a digital

16 broadcasting service and an Internet provider server to a subscriber; a set-top box for separating data

17 received through the transmission media into digital broadcasting data and Internet data and

18 outputting both data to corresponding units; a television set for receiving the digital broadcasting

19 data outputted from the set-top box separately and processing the data; and a computer for receiving

20 the Internet data outputted from the set-top box separately and processing the data, wherein the

21 set-top box compares an IP address of a received IP packet with a broadcasting IP address assigned

1   previously by a user, and processing the IP packet in an MPEG-N TS processing unit when the IP

2   packet is determined as the broadcasting IP address, and outputting the IP packet to a computer

3   directly when the IP packet is determined not to be the broadcasting IP address assigned previously.

4   [0022]   Preferably, the set-top box includes a reception buffer for receiving the IP packet; an IP

5   header extractor for extracting an IP header from the IP packet outputted from the reception buffer;

6   a comparator for comparing the address of the IP header extracted from the IP header extractor with

7   the IP address assigned previously by the user; a register for storing the broadcasting IP address value

8   set by the user; an IP packet path processing unit for selecting an IP packet path according to a result

9   value of the comparison outputted from the comparator; a transmission buffer for transmitting the

10   IP packet in order to return the IP packet from the IP packet path processing unit to the computer,

11   in case that the result value of the comparison is determined to be the IP address corresponding to

12   general Internet data; and an MPEG-TS processing unit for processing the IP packet outputted from

13   the IP packet path processing unit, in case that the result value of the comparison of the comparator

14   is determined to be an IP address corresponding to a digital broadcasting signal.

15   [0023]   In accordance with another aspect of the present invention, there is provided a method for

16   separating a digital broadcasting signal from data transmitted using an Internet network, including

17   the steps of: receiving an Internet Protocol (IP) packet by a buffer; copying an IP header from the

18   received IP packet and extracting the IP header; comparing the extracted IP header (IP address) with

19   a broadcasting IP address assigned previously by a user; outputting the IP packet to a Moving Picture

20   Experts Group-N Transport Stream (MPEG-N TS) processing unit, in case that the extracted IP

21   header is identical with the broadcasting IP address; and outputting the IP packet to a computer, in

1   case that the extracted IP header is not identical with a broadcasting IP address.

2   **BRIEF DESCRIPTION OF THE DRAWINGS**

3   **[0024]**   A more complete appreciation of the invention, and many of the attendant advantages

4   thereof, will be readily apparent as the same becomes better understood by reference to the following

5   detailed description when considered in conjunction with the accompanying drawings in which like

6   reference symbols indicate the same or similar components, wherein:

7   **[0025]**   Fig. 1 is a view showing a block diagram of a processing unit for serving a digital

8   broadcasting signal using an ATM network using an ATM network in the art;

9   **[0026]**   Fig. 2 is a view showing a block diagram of an apparatus for processing a digital

10   broadcasting signal using an IP network in the art;

11   **[0027]**   Fig. 3 is a view showing a block diagram of an apparatus for separating a digital ·

12   broadcasting signal and Internet data from each other at a rapid speed in a digital broadcasting

13   service system using an IP network in accordance with the present invention;

14   **[0028]**   Fig. 4 is a view showing a procedure for performing a comparison of IP address on the

15   basis of a protocol stack in accordance with the present invention;

16   **[0029]**   Fig. 5 is a view showing a block diagram of a digital broadcasting signal separation unit

17   for embodying the present invention;

18   **[0030]**   Fig. 6 is a view showing a block diagram of a unit for separating a digital broadcasting

19   signal and Internet data in accordance with a preferred embodiment of the present invention;

20   **[0031]**   Fig. 7 is a flow chart showing a method for separating the digital broadcasting signal and

1   the Internet data in accordance with a preferred embodiment of the present invention; and

2   [0032]   FIG. 8 shows an example of a computer including a computer-readable medium having

3   computer-executable instructions for performing a method of the present invention.

4   ## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

5   [0033]   Now, preferred embodiments of the present invention will be described in detail with

6   reference to the annexed drawings in order that those skilled in the art can embody the present

7   invention with ease.

8   [0034]   Fig. 3 is a view showing a block diagram of an apparatus for separating a digital

9   broadcasting signal and Internet data from each other at a rapid speed in a digital broadcasting

10   service system using an IP network in accordance with the present invention.

11   [0035]   Referring to Fig. 3, a set-top box for separating a digital broadcasting signal and Internet

12   data includes a transmission media 100 such as xDSL, Ethernet, optic, cable modem and wireless

13   LAN (Local Area Network) for transmitting a public digital broadcasting stream provided from a

14   broadcasting station server and Internet data provided from an Internet Service Provider; and a

15   set-top box 200 for separating the digital broadcasting stream and the Internet data transmitted

16   through the transmission media 100 from each other and transmitting them to the corresponding

17   outputs (for example, a television set 400 or a computer 300).

18   [0036]   The set-top box 200 includes an IP interface 210 for interfacing data transmitted through

19   an IP network; a data separator 220 for separating the Internet data and the digital broadcasting

1   signal; an MPEG decoder 230 for decompressing the compressed digital broadcasting signal in a

2   form of MPEG and converting it to a signal which can be processed in the television set 400; and

3   a DAC (Digital /Analog Converter) 240 for converting the digital broadcasting signal outputted from

4   the MPEG decoder 230 to an analog broadcasting signal and outputting it.

5   **[0037]**   In case that the television set 400 is a digital television set, the DAC 240 is not needed in

6   the set-top box 200.

7   **[0038]**   Herein, an analog television set used currently is explained as an example.

8   **[0039]**   Hereinafter, a data separation procedure and data separator 220 of a characteristic of the

9   present invention will be explained in detail, wherein the digital broadcasting signal and the Internet

10   data are separately processed.

11   **[0040]**   Fig. 4 is a view showing a procedure for performing a comparison of IP address on the

12   basis of a protocol stack in accordance with the present invention.

13   **[0041]**   Referring to Fig. 4, when a broadcasting MPEG TS (MD) and Internet data (D) are

14   inputted to a set-top box 200 through a transmission media 100, they are divided into a digital

15   broadcasting signal packet MD1 and an Internet data packet D' in the data separator 220 of the

16   set-top box 200.

17   **[0042]**   An IP header MD2 of the digital broadcasting signal packet MD1 is compared with an IP

18   address value MDH which is stored in a look up table T and assigned by a user. Here, when the IP

19   header is identical with the assigned address value of the IP address, the IP header is removed and

20   a User Datagram Protocol (UDP) field and a payload MD3 remain.

21   **[0043]**   When an MPEG-N stream corresponding to a real payload MD4 remains after the UDP

1   field is removed from the remaining UDP field and the payload MD3 is restored to an MPEG stream

2   transmission unit (TS) MD5, it is outputted to the MPEG decoder 230 and decompressed, and

3   converted to an analog signal in the DAC 240 and transmitted to the television set 400.

4   [0044]   Hereinafter, a digital broadcasting signal separation unit for embodying the data processing

5   procedure as described above will be explained.

6   [0045]   Fig. 5 is a view showing a block diagram of a digital broadcasting signal separation unit

7   for embodying the present invention.

8   [0046]   Fig. 6 is a view showing a block diagram of a unit for separating a digital broadcasting

9   signal and Internet data in accordance with a preferred embodiment of the present invention.

10 [0047]   Referring to Figs. 5 and 6, the digital broadcasting signal separation unit has an IP

11 processing unit A 202a to extract an IP header from an IP packet. An IP header 202b and a filtered

12 IP header 205 are compared in an exclusive OR gate XOR1.

13 [0048]   The digital broadcasting signal separation unit includes a reception buffer 201 for receiving

14 an IP packet transmitted through a transmission media 100; an IP header extractor 202 for copying

15 an IP header from the IP packet outputted from the reception buffer 201 and extracting the header

16 only; a register 204 for storing a multicast IP address value or a unicast IP address value including

17 information on a broadcasting channel established by users; a comparator 203 for comparing an

18 address of the IP header 202b extracted from the IP header extractor 202 and an address of the IP

19 header 205 stored in the register 204; an IP packet path processing unit 206 for selecting an IP packet

20 path according to a result value of the comparison outputted from the comparator 203; a transmission

21 buffer 207 for transmitting the IP packet in order to return the IP packet to the computer from the

1 IP packet path processing unit 206, in case that the result value of the comparison in the comparator

2 203 is determined to be an IP address corresponding to normal Internet data; and an MPEG-N TS

3 processing unit 209 for processing the IP packet outputted from the IP packet path processing unit

4 206, in case that the result value of the comparison in the comparator 203 is determined to be an IP

5 address corresponding to a digital broadcasting signal.

6 **[0049]** Here, when it is required that a UDP port filtering function is added in order to receive data

7 more stably, it is possible to install a UDP (User Datagram Protocol) processing unit 208 between

8 the IP packet path processing unit 206 and the MPEG-N TS (MPEG-TS) processing unit 209 so as

9 to filter a UDP field of the IP packet by comparing the UDP field with a UDP port assigned by the

10 user.

11 **[0050]**   Hereinafter, a detailed construction of a digital broadcasting signal separation unit is

12 explained.

13 **[0051]** Referring to Fig. 6, the digital broadcasting signal separation unit has an IP processing unit

14 A 202a to extract an IP header from the IP packet. The IP header 202b and the filtered IP header 205

15 are compared in an exclusive OR gate XOR1. Here, the method of how the filtered IP header 205

16 and an IP header 202b of an incoming IP packet are compared in the exclusive OR gate XOR1 is

17 described in Table 1.

[0052] Table 1

Filtered IP header	Incoming IP header	Comparison result
yyy.yy1.y1.x	xxx.yy0.yy0.x00	Outputting value '1', returning it to computer
yyy.yy1.y1.x	xxx.yy0.yy0.x00	Outputting value '1', returning it to computer
xxx.yy0.yy0.x00	xxx.yy0.yy0.x00	Outputting the identical value '0'
yyy.yy1.y1.x	xxx.yy0.yy0.x00	Outputting value '1', returning it to computer

[0053] For example, in case that a user wishes to watch a Korean Broadcasting system 1 (referred to as an KBS 1, hereinafter) (239.0.1.1) , an address part of the IP packet is encapsulated into the multicast IP address (239.0.1.1) and then the broadcasting signal is transmitted from the KBS 1. The IP packet is transmitted to each set-top box through the Internet network. Since the 239.0.1.1 has been already registered at the filtered IP header 205 in the set-top box, the output value of the exclusive OR gate XOR1 becomes 0.0.0.0.

[0054] Accordingly, a result value processing unit 203a outputs a switching signal to a switch 206a in order to process the current IP packet as the digital broadcasting signal. Therefore, the IP packet outputted from the IP processing unit A 202a is passed to an IP processing unit B 206b through the switch 206a. Then the IP header of the IP packet is removed in the IP processing unit B 206b and the remaining part of the IP packet is outputted to the UDP processing unit 208.

[0055] Here, the control point of the result value processing unit 203a is matched with the point

1   that the IP packet is transmitted to the switch 206a from the IP processing unit A 202a.

2   [0056]   On the other hand, in case that the IP header of the current incoming packet is not identical

3   with the IP address assigned by users as a result of the comparison, the exclusive OR gate XOR1

4   outputs a value including '1' instead of '0.0.0.0'. Therefore, the result value processing unit 203a

5   outputs a switching signal to the switch 206a so as to process the current IP packet as the Internet

6   data.

7   [0057]   Accordingly, the IP packet outputted from the IP processing unit A 202a is transmitted to

8   the transmission buffer 207 from the switch 206a and processed in the computer 300.

9   [0058]   On the other hand, when the UDP processing unit 208 receives from the IP processing unit

10   B 206b a packet whose IP header is removed, the UDP processing unit 208a extracts the UDP header

11   208b and compares it with the UDP header 208c stored in the filtering register 204.

12   [0059]   Here, the values to be compared are port numbers recorded on the UDP header. In case that

13   the port number (that is, filtered UDP header) assigned previously by the user is identical with the

14   porter number recorded on the current incoming UDP header, the exclusive OR gate XOR2 outputs

15   '0, and determines that data is normally received in the final processing unit 208d without any loss.

16   So, the packet outputted from the UDP processing unit 208a without the UDP header is transmitted

17   to the MPEG-N TS processing unit 209 as an effective signal so as to be processed in it.

18   [0060]   However, in case that the port number (that is, filtered UDP header) assigned previously

19   by the user is not identical with the port number recorded on the current incoming UDP header, the

20   exclusive OR gate XOR2 outputs '1, and the final processing unit 208d determines that data is not

21   received abnormally. Therefore, the final processing unit outputs signal 'discard' (discarding data)

1   for the packet received.

2   **[0061]**   Hereinafter, the method for separating the digital broadcasting signal and the Internet data

3   will be explained.

4   **[0062]**   Fig. 7 is a flow chart showing a method for separating a digital broadcasting signal and

5   Internet data in accordance with a preferred embodiment of the present invention.

6   **[0063]**   Referring to Fig. 7, the method for separating the digital broadcasting signal and the

7   Internet data includes a step of receiving an IP packet through a transmission media and storing the

8   received IP packet into a buffer (S100).

9   **[0064]**   When the IP packet extracts an IP header (S210), address information of a separated IP

10   header and an IP address item assigned previously by a user are compared (S220).

11   **[0065]**   If it is determined that an IP address of the IP header separated in the step S220 is identical

12   with a broadcasting IP address (set in an IP lookup table), the corresponding IP packet is outputted

13   to an MPEG-N TS (Moving Picture Experts Group-N Transport Stream) processing unit 209 (S230).

14   An MPEG compression file is decompressed in the MPEG-N TS processing unit 209, converted to

15   an analog signal and outputted to an analog television set (S240).

16   **[0066]**   However, if it is determined that the IP address of the separated IP header is not identical

17   with the broadcasting IP address, the corresponding IP packet is outputted to the computer (S250).

18   **[0067]**   If it is required that a UDP filtering procedure be added, a UDP filtering procedure can be

19   performed before performing S230.

20   **[0068]**   The present invention can be realized as computer-executable instructions in

21   computer-readable media. The computer-readable media includes all possible kinds of media in

1   which computer-readable data is stored or included or can include any type of data that can be read

2   by a computer or a processing unit. The computer-readable media include for example and not.

3   limited to storing media, such as magnetic storing media (*e.g.*, ROMs, floppy disks, hard disk, and

4   the like), optical reading media (*e.g.*, CD-ROMs (compact disc-read-only memory), DVDs (digital

5   versatile discs), re-writable versions of the optical discs, and the like), hybrid magnetic optical disks,

6   organic disks, system memory (read-only memory, random access memory), non-volatile memory

7   such as flash memory or any other volatile or non-volatile memory, other semiconductor media,

8   electronic media, electromagnetic media, infrared, and other communication media such as carrier

9   waves (*e.g.*, transmission via the Internet or another computer). Communication media generally

10 embodies computer-readable instructions, data structures, program modules or other data in a

11 modulated signal such as the carrier waves or other transportable mechanism including any

12 information delivery media. Computer-readable media such as communication media may include

13 wireless media such as radio frequency, infrared microwaves, and wired media such as a wired

14 network. Also, the computer-readable media can store and execute computer-readable codes that

15 are distributed in computers connected via a network. The computer readable medium also includes

16 cooperating or interconnected computer readable media that are in the processing system or are

17 distributed among multiple processing systems that may be local or remote to the processing system.

18 The present invention can include the computer-readable medium having stored thereon a data

19 structure including a plurality of fields containing data representing the techniques of the present

20 invention.

21 **[0069]**   An example of a computer, but not limited to this example of the computer, that can read

1   computer readable media that includes computer-executable instructions of the present invention

2   is shown in FIG. 8. The computer 800 includes a processor 802 that controls the computer 800. The

3   processor 802 uses the system memory 804 and a computer readable memory device 806 that

4   includes certain computer readable recording media. A system bus connects the processor 802 to

5   a network interface 808, modem 812 or other interface that accommodates a connection to another

6   computer or network such as the Internet. The system bus may also include an input and output

7   interface 810 that accommodates connection to a variety of other devices.

8   [0070]   As described above, in accordance with the present invention, it is possible to extract a

9   digital broadcasting signal from an IP network with ease without using an expensive network

10   processor (for example, ATM interface) in a set-top box capable of receiving a digital broadcasting

11   signal through an Internet network.

12   [0071]   Accordingly, since the Internet data and the digital broadcasting signal can be separated

13   at a wire speed by extracting directly an IP header of an incoming IP packet in a hardware scheme

14   without storing the IP packet in a special memory, a user can receive the broadcasting service

15   rapidly.

16   [0072]   Although the preferred embodiments of the present invention have been disclosed for

17   illustrative purposes, those skilled in the art appreciate that various modifications, additions and

18   substitutions are possible, without departing from the scope and spirit of the invention as disclosed

19   in the accompanying claims.